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NASA TECH BRIEF

Goddard Space Flight Center

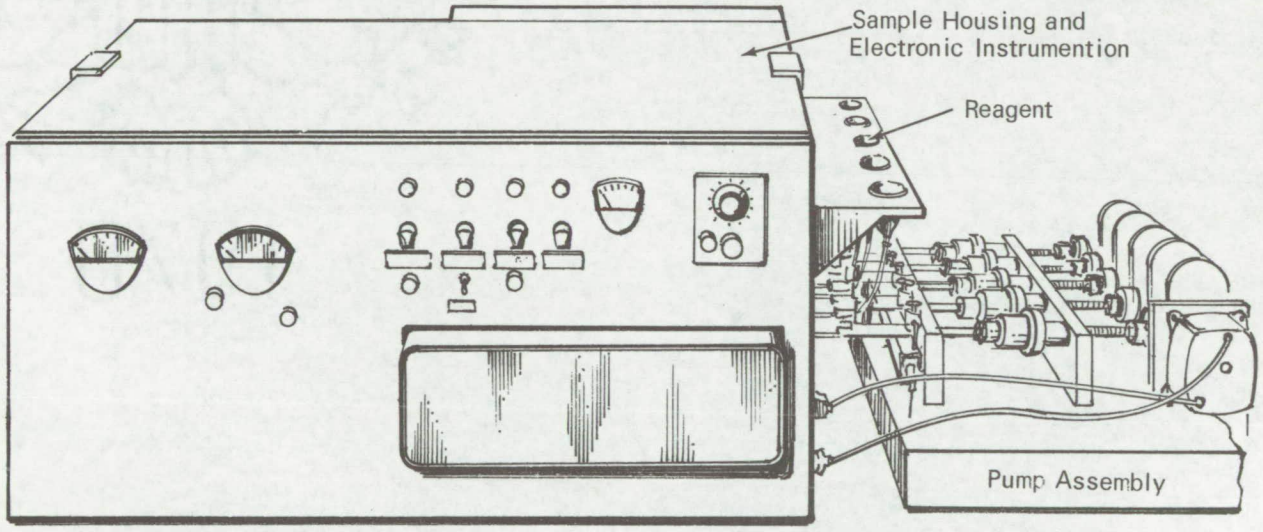
Automatic Bio-Sample Bacteria Detection System

An automatic electromechanical device dramatically reduces the time required for bio-sample analysis in the detection of bacteria. Bio-samples, such as urine specimens, can be analyzed in 15 minutes, and the instrument processes a sample a minute. Since urinary tract infections are indications of kidney or bladder disease or diabetes, and since the occurrence of such infections in the United States is second only to that of respiratory ailments, urinalysis is one of the most important and frequently conducted procedures in the clinical laboratory.

Present urinalysis techniques involve incubating the specimen with a nutrient for one or two days, and counting the visible number of bacterial colonies. This number provides an accurate index of the number of viable cells capable of dividing. However, considerable time is required to complete the analysis, and the process can only be performed in the laboratory by highly skilled microbiology technicians.

With the device just developed, the time and skill required for such analyses are minimized, and, although the unit has only been built in prototype, it is conceivable that it could be made portable for non-laboratory use.

Basic research behind the system design concerned means of detecting microbiological life on other planets, using two chemicals—luciferase and luciferin—found in the common firefly. These chemicals produce a bioluminescent reaction when in contact with adenosine triphosphate (ATP), which is found in all living organisms. In urine samples, the concentration of bacterial ATP is directly proportional to the number of bacteria present in the sample.



In operation, the vials containing the urine samples are placed in openings in the periphery of the revolving table inside the light-tight housing. As the table turns, a series of spouts located at specific points around the table sequentially dispense chemical reagents into the

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vials to remove ATP from nonbacterial sources and release bacterial ATP. The amount of reagent dispensed by each spout is controlled by a pump system located outside the housing. At the final test point, a photomultiplier tube senses the light from the bioluminescent reaction in the urine when the luciferase-luciferin mixture is added. The output signal from this photomultiplier is directly proportional to the bacterial ATP concentration, which in turn is proportional to the number of bacteria present in the sample. When the reaction measurement is completed, the vials are ejected from the table.

The instrument has potential application to other physiological fluids, such as blood or spinal fluid, in tests where bacterial count is of immediate importance. It can also be used to detect and count bacteria in any fluid source containing living organisms, including water supplies.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free nonexclusive licences for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to:

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